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## NEW NEARCTIC CRANE-FLIES (TIPULIDAE, DIPTERA), PART XIX

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The crane-flies considered herewith are all from Western North America, from British Columbia to California. The names of the collectors and the location of the type material are indicated at the end of the individual specific accounts; where not stated to the contrary, such types are preserved in my own collection of these flies.

### *Tipula* (*Trichotipula*) *repulsa* n. sp.

General coloration brown, the mesonotal praescutum with a central brownish gray stripe; antennal flagellum black; halteres relatively short; wings with a brownish tinge, the large oval stigma dark brown; obliterative areas conspicuous; abundant macrotrichia in outer cells of wing; abdomen obscure yellow, the tergites conspicuously ringed caudally with dark brown; male hypopygium with the inner disti-style relatively complex, the beak terminating in a slender blackened spine, with a second marginal spine a short distance back from the tip; outer basal lobe produced backward into a long-oval flattened blade; aedeagus elongate, consisting of two paired rods.

*Male.* Length about 10-10.5 mm.; wing 10-11 mm.; antenna about 3.6-4 mm.

Frontal prolongation of head relatively short, brownish yellow, darker beneath; nasus elongate, tufted with black setae; palpi black. Antennae of moderate length; scape and pedicel yellow, flagellum black; flagellar segments moderately incised; longest verticils a little shorter than the segments. Head with the front pale yellow, the color continued caudad as a less distinct median vitta onto the vertex; sides of vertex more infuscated, sparsely pruinose; posterior orbits narrowly gray.

Pronotum narrowly yellow on central portion, dark brown sublaterally. Mesonotal praescutum with the central stripe brownish gray, not as distinctly pruinose as in allied Western Nearctic species of the subgenus, narrowly bordered laterally by brown, the cephalic portion indistinctly divided by a dark vitta; lateral stripes light brown, conspicuously bordered by dark brown; lateral and humeral portions of praescutum yellowish testaceous; scutum dark brown, each lobe with two confluent paler brown areas; scutellum testaceous yellow, the parascutella darker; postnotum brown, the surface sparsely pruinose. Pleura pale testaceous brown, sparsely pruinose, patterned with dark brown on the propleura, ventral anepisternum and ventral meron. Halteres relatively short, stem pale, restrictedly yellow at base, knob dark brown, the apex a trifle brightened. Legs with the coxae pale yellow, narrowly dark brown on bases; trochanters yellow; femora yellow, the tips narrowly brownish black; tibiae and basitarsi obscure yellow, the outer tarsal segments passing into black. Wings with a brownish tinge, the centers of the outer cells somewhat brightened; stigma oval, large and conspicuous, dark brown; cell *Sc* slightly darkened; obliterative areas conspicuous, including post-stigmal and pre-stigmal brightenings and an isolated mark across cell *1st M*<sub>2</sub>, including the adjoining portions of cells *R* and *M*<sub>3</sub>; veins brown, yellowish or bullate in the obliterative portions. Macrotrichia of cells unusually abundant, from cells *R*<sub>3</sub> to *2nd M*<sub>2</sub>, inclusive; stigma with several trichia. Venation: *Rs* arcuated, subequal in length to *m-cu*; petiole of cell *M*<sub>1</sub> subequal to *m*.

Abdominal tergites obscure yellow basally, passing into brown to produce dark brown rings at the apices and lateral margins of the segments, becoming more extensive on the outer segments; basal sternites yellow, the intermediate ones extensively darkened, the posterior margins pale; hypopygium brownish yellow. Male hypopygium with the caudal margin of tergite having a very broad U-shaped emargination, the border and surface back therefrom with numerous blackened spinous points. Outer dististyle a long flattened blade, widest just beyond midlength. Inner dististyle relatively complex, the beak portion blackened, terminating in a strong black spine, with a second, slightly curved spine, on outer margin a short distance back from tip; ventral margin of blackened portion microscopically roughened or feebly toothed; outer basal lobe a conspicuous, long-oval, flattened blade, its apex obtusely rounded, the surface with abundant long setae. Aedeagus consisting of two long exerted paired rods, each with the apex decurved and with a rounded knob on lower margin at near midlength. Eighth sternite moderately projecting, its caudal margin gently emarginate, the notch with pale membrane; each lateral angle produced into a rounded knob set with a few long, coarse setae.

*Habitat.* British Columbia, California.

*Holotype.* ♂, Terrace, British Columbia, August, 1937 (Mrs. M. E. Clark); received through C. A. Frost. *Paratypes*, 1 ♂, Green Valley, Solano Co., California, June 13, 1939 (G. Bohart); 1 ♂, Mormon Bar, Mariposa Co., California, June 6, 1940 (T. H. G. Aitken).

This fly is very different from the other Western Nearctic species of the subgenus, differing especially in the abundant macrotrichia of the cells of the wing, in conjunction with the details of structure of the male hypopygium. Among such species, it is closest to *Tipula* (*Trichotipula*) *dorsolineata* Doane and *T. (T.) apache* Alexander.

#### ***Tipula* (*Yamatotipula*) *glendenningi* n. sp.**

General coloration gray, the praescutum with four darker gray stripes that are bordered by dark brown; antennae black throughout, the scape and pedicel a trifle pruinose; wings almost uniformly tinged with brown, the costal region and stigma a trifle darker; very restricted pale oblitative areas before the stigma and cord; male hypopygium with the tergite terminating in a single very broad lobe, its narrowly obtuse apex set with blackened spinous points; inner dististyle complex, the inner blade or beak large and compressed.

*Male.* Length about 11-12 mm.; wing 11.5-13 mm.; antenna about 5.5-2 mm.

*Female.* Length about 13 mm.; wing 13.5 mm.; antenna about 2.3 mm.

Frontal prolongation of head gray above, yellow on sides and beneath; nasus long and conspicuous; palpi brownish black. Antennae (male) relatively long, as shown by the measurements; black, the scape and pedicel a trifle pruinose; flagellar segments moderately incised, with unusually short verticils. Head gray, more infuscated on vertex, with a further well-defined median black vitta.

Pronotum brownish gray; scutellar lobes more yellowish; pretergites gray. Mesonotal praescutum gray, with four slightly darker gray stripes that are indicated chiefly by narrow dark brown borders, those of the intermediate pair becoming subobsolete before the suture; posterior sclerites of notum gray, the scutal lobes a trifle darker but without well-delimited darker areas; scutellum and postnotum with a delicate, median, brown vitta. Pleura clear gray, the pteropleurite and metapleura somewhat lighter; dorsopleural membrane light brown, more buffy on the margins, especially near the spiracle. Halteres brownish yellow, the knobs darker brown. Legs with the coxae gray, their apices paling to buffy; trochanters obscure yellow; femora and tibiae obscure yellow, their tips infuscated; tarsi passing into black; claws (male) toothed.

Wings with a strong and almost uniform brown tinge, the costal region and stigma a trifle darker; very restricted oblitative areas before the stigma and across base of cell 1st  $M_2$ , the latter especially inconspicuous; veins brown. Venation:  $R_s$  approximately twice  $m-cu$ , in cases a little longer; petiole of cell  $M_1$  variable, from a little longer than  $m$  to twice the length of this vein.

Abdomen dark gray, the tergites with sublateral brown stripes that are interrupted by narrow but conspicuous yellow posterior borders to tergites three to eight, inclusive; lateral tergal borders broadly bright yellow; sternites brownish gray, the caudal borders of segments four to eight narrowly yellow; ninth tergite and the appendages chiefly dark brown; ninth sternite conspicuously yellow. Male hypopygium with the blades of the gonapophyses projecting caudad beyond the genital chamber and visible in lateral aspect beneath the bases of the dististyles. Ninth tergite terminating in a very broad, simple lobe, the tip narrowly obtuse, set with numerous blackened pegs that extend cephalad along the margins of lobe almost to base; on lower surface, near base of lobe on either side, a smaller group of more than a score of blackened spines; dorsal surface of tergal lobe provided with abundant long black setae, directed caudad. Outer dististyle oval, its tip obtuse; greatest width at a little more than midlength. Inner dististyle consisting of a large compressed outer blade or beak and a more complex basal mass; blade terminating in a short obtuse point, the outer or crest portion with numerous long, pale setae that are strongly recurved at tips; basal mass of style subequal in extent to the outer blade, in part heavily blackened and produced into a spinous point, the apex of the mass extended into two closely applied obtuse lobes or points, the outer of which bears about six conspicuous setae. Gonapophyses longer than the aedeagus, the stem slender, the blade conspicuously expanded, obtuse. Eighth sternite unarmed.

*Habitat.* British Columbia.

*Holotype.* ♂, Agassiz, July 24, 1922 (R. Glendenning); Canadian National Collection. *Allotopotype*, ♀, with the type; Canadian National Collection. *Paratopotype*, 1 ♂; Alexander Collection.

*Tipula (Yamatotipula) glendenningi* is named in honor of the collector. The species is most similar to the Eastern Arctic *T. (Y.) grenfelli* Alexander and the Vancouverian *T. (Y.) cervicula* Doane, differing from both in the coloration of the body and wings, the more elongate antennae with unusually short verticils, and, especially, the very different male hypopygium.

### ***Tipula (Tipula) spenceriana* n. sp.**

Allied to *ultima*; male hypopygium with the lateral tergal lobes microscopically toothed; plate of ventral surface of tergite Y-shaped; inner dististyle with rostral prolongation slender, with scattered setigerous punctures only.

*Male.* Length about 14-15 mm.; wing 16-17.5 mm.

*Female.* Length about 16-17 mm.; wing 15-16 mm.

Frontal prolongation of head brownish yellow; nasus distinct; palpi obscure yellow, the outer segments more infuscated. Antennae with the basal three segments yellow; succeeding segments conspicuously bicolored, yellow, with brownish black basal enlargements; flagellar segments rather strongly incised. Head brownish gray, paler in front; vague indications of a capillary darker median vitta, this line free from setigerous punctures.

Pronotum brownish yellow. Mesonotal praescutum pale yellowish gray, with three poorly differentiated reddish brown stripes, the median one broad; scutal lobes reddish gray; scutellum and postnotum more cinereous, with a more or less distinct median darker vitta. Pleura yellow, very sparsely gray pruinose. Halteres with stem yellow, knob weakly darkened. Legs with the coxae yellow, very sparsely pruinose; trochanters yellow; femora yellow, the tips narrowly infuscated; tibiae and basal tarsal segments yellow, the tips even more

narrowly darkened; terminal tarsal segments dark. Wings with a strong brownish yellow tinge, with small but conspicuous brown clouds at end of *Sc*, at outer end of the otherwise yellow stigmal area, near outer end of cell *M* adjoining vein *Cu*, and a major marginal cloud at end of vein 2nd *A*; veins obscure yellow to pale yellowish brown; obliterative area before cord relatively conspicuous, extending from before the stigma into cell 1st *M*<sub>2</sub>. Venation: *Rs* subequal in length to vein *R*<sub>4</sub>; petiole of cell *m*<sub>1</sub> subequal to or longer than *m*.

Abdomen obscure yellow, the tergites with three more or less distinct longitudinal stripes, the median one more or less interrupted on the basal ring of the segment, forming elongate darkened triangles behind; lateral dark tergal stripes more continuous; sternites yellow, the outer segments more or less darkened medially; hypopygium yellow. Male hypopygium with the lateral lobes of tergite narrowly blackened and microscopically toothed to crenulate, the outermost denticles largest; plate of ventral surface of tergite Y-shaped, the two divergent arms arising from a relatively narrow common base that is approximately as long as either arm. Inner dististyle with the rostrum relatively slender, provided with relatively few scattered setigerous punctures, entirely without microscopic spicules, as is the case in *ultima*.

*Habitat.* British Columbia.

*Holotype.* ♂, Chilcotin, August 21, 1930 (G. J. Spencer).

*Allotopotype*, ♀. *Paratopotypes*, 6 ♂ ♂, some badly broken.

*Holotype* returned to Professor Spencer.

*Tipula* (*Tipula*) *spenceriana* is dedicated to the collector, Professor George J. Spencer. The species is closest to *T. (T.) hardyi* Alexander, as indicated by the comparisons below; the two flies are most readily separated by the details of structure of the male hypopygium, especially the nature of the tergal furcula and the toothings of the tergal lobes. The allied Nearctic species are as follows.

*Tipula* (*Tipula*) *hardyi* Alexander. (Great Basin). Margin of tergite almost entire, with very low to scarcely indicated crenulations, only the most lateral spine being developed as such; furcula of tergite represented by two entirely separate spines, the distance between these at base at least as much as the length of either spine; inner dististyle with rostrum only slightly produced, provided with simple setigerous punctures only.

*Tipula* (*Tipula*) *ultima* Alexander. (Eastern North America). Margin of tergite conspicuously denticulate; furcula of tergite with base long and narrow, exceeding the length of either arm; inner dististyle with the rostral prolongation greatly produced and provided with abundant spicules.

#### ***Tipula* (*Tipulodina*) *lactelipes* n. sp.**

General coloration gray, the praescutum with four clearly defined, entire, dark brown stripes; antennae black throughout, of moderate length; legs dark brown to black, the tips of basitarsi and all of tarsal segments two to four snowy white; wings with a strong brownish tinge, the stigma darker, the extreme tip of wing a little more suffused; male hypopygium small, tergite narrowly transverse; outer dististyle widely expanded; inner dististyle long and narrow, without a developed outer basal lobe.

*Male.* Length about 14 mm.; wing 15 mm.; antenna about 4.5 mm.

Frontal prolongation of head light gray, of moderate length, a trifle over one-half the length of remainder of head; nasus distinct; palpi with basal segment dark brown, the remainder much paler, yellowish brown. Antennae black throughout, of moderate length, as shown by the measurements; flagellar segments rather strongly incised, the longest verticils subequal in length to the segments; terminal segment a little more than one-third the length of the penultimate. Front and anterior vertex clear light gray, the posterior vertex with an extensive brown area on either side, immediately behind the eyes; the



narrow central region and the occiput darker gray; anterior vertex broad, exceeding five times the diameter of scape.

Pronotum gray, vaguely patterned with brown on median portion of scutum. Mesonotal praescutum clear light gray, with four narrow, entire, dark brown stripes; intermediate pair separated by a ground vitta that is about one-half the width of either stripe, this pale line narrowed behind; posterior interspaces weakly infuscated; scutum gray, each lobe with two disconnected brown areas, the posterior one largest; scutellum and postnotum light gray; pleurotergite weakly patterned with brown on ventral portion of its two subdivisions. Pleura light gray, variegated with slightly darker gray areas on the ventral portions of anepisternum, sternopleurite and meron; dorsopleural membrane clear yellow. Halteres with the stem yellow, brightest at base, knob dark brown. Legs with coxae light gray pruinose; trochanters yellow; femora dark brown, the bases restrictedly brighter, the tips narrowly blackened; tibiae black; basitarsi black, the outer fourth snowy white; segments two to four similarly white, the terminal segment abruptly black; claws (male) sparsely hairy, with a strong tooth before midlength; (fore legs broken; from analogy with other species of the subgenus, possibly differing in color from the middle and hind pairs). Wings with a strong brownish tinge that is a little more suffused at the extreme tip; a similarly darkened longitudinal central streak extending for almost the whole length of cell *R*; stigma with cephalic portion pale brown, the posterior half darker brown. Macrotrichia of veins unusually abundant for a member of this subgenus, including complete series on all veins beyond cord excepting the outer end of  $R_{1+2}$ . Venation:  $Sc_2$  ending about opposite five-sixths the length of  $R_s$ , the latter long, more than twice the length of  $R_{2+3}$ ; cell  $M_1$  deep, exceeding twice the length of its petiole; cell 1st  $M_2$  elongate; *m-cu* relatively long and sinuous, placed at near midlength of  $M_{3+4}$ ;  $Cu_1$  bent strongly caudad at outer end; cell 2nd *A* relatively wide.

Abdominal tergites chiefly brown, especially on the sublateral portions, appearing as distinct, scarcely broken stripes, broader and more conspicuous on segments four to seven, inclusive; median area of tergites gray pruinose; basal tergite brown, with an oval, light gray, median area, the base and apex of the segment restrictedly yellow; fifth to seventh tergites more conspicuously overcast with gray, the caudal borders restrictedly yellow; eighth and ninth tergites blackened; basal sternites concealed by the over-lapping tergal borders, the outer exposed segments brownish gray, with narrow yellow posterior borders; ninth sternite reddish brown, bordered posteriorly by yellow, the lobes and styli similarly yellow. Male hypopygium relatively small and simple in structure. Ninth tergite small, entirely separated from the very extensive combined basistyle-ninth sternite, the suture between the two latter indicated only by a very short line on ventral portion. Ninth tergite relatively narrow, much broader than long, its caudal margin very gently emarginate; on caudo-ventral surface of this border with a narrow flange that is produced into a low triangular median tooth that is scarcely evident from above; setae of tergal surface lacking on midline and cephalic border. Region of basistyle not produced into a spine or point. Outer dististyle very broad, spatulate, its greatest width approximately three-fourths the length; apex very obtuse; setae chiefly grouped on the more thickened upper margin but with further sparse bristles on disk. Inner dististyle unusually long and narrow, sinuous, without a developed outer basal lobe, as is common in the genus; rostrum long and slender, blackened; before midlength of style with a group of from 8 to 10 bristles, immediately distad of which is a small semicircular or horseshoe-shaped chitinated structure, its opening on the outer end. Lobe of ninth sternite very small, oval; ventral surface of sternite very extensive, with a deep median furrow or split extending the entire length. Aedeagus a relatively short black rod, before apex with a small erect chitinated spine. Gonapophyses united into a phallosome at base of

aedeagus, each outer angle produced into a pale triangular ear, the whole phallosomic plate provided with very abundant short setulae. Eighth sternite with margin narrowly pale, unarmed with lobes or setae.

*Habitat.* California (Mariposa Co.)

*Holotype*, ♂, Wawona, altitude 5,000 ft., June 5, 1939 (A. Downes).

This is one of the most interesting species of the genus so far discovered in the Nearctic Region, being the first such form to be discovered having white feet. By my key to the subgeneric groups of *Tipula* in Asia (Philippine Journ. Sci., 57:83-85; 1935), the fly runs with little difficulty to the subgenus *Tipulodina* Enderlein, hitherto known only from Asia and Africa and including about 35 known species. The present fly disagrees from the characters of these species in certain characters, especially in various details of the male hypopygium, but I can see no reason for not referring it to this subgenus.

### *Tipula* (*Lunatipula*) *truculenta* n. sp.

General coloration brownish yellow, the praescutum with four poorly differentiated reddish brown stripes, the narrow intermediate pair faintly bordered by darker brown; wings grayish, the costal border and stigma darker; obliterative area before cord very little evident; male hypopygium with the caudal border of tergite almost detached from the main body of the sclerite by pale membrane, appearing as a thickened corrugated collar; outer dististyle expanded outwardly, unequally bilobed; posterior margin of inner dististyle near base with two powerful spines; eighth sternite narrow, sheathing, terminating in two lobes that are separated by a deep V-shaped notch, each lobe with a dense brush of unusually long yellow setae.

*Male.* Length about 15 mm.; wing 17 mm.; antenna about 5.6 mm.

Frontal prolongation of head relatively long, exceeding in length the remainder of head, obscure yellow; nasus conspicuous; palpi brown, the terminal segment brownish black. Antennae (male) relatively long; scape and pedicel light yellow; first flagellar segment obscure brownish yellow, succeeding flagellar segments almost uniformly brownish black but with the basal swelling a trifle deeper in color than the pedicel; segments rather strongly incised; longest verticils subequal in length to the segments. Head dark gray, the front and orbits lighter gray; anterior vertex with a conspicuous dark brown area paling behind; vertical tubercle very low.

Pronotum obscure brownish yellow. Mesonotum obscure brownish yellow with four poorly differentiated, more reddish brown stripes, the intermediate pair unusually narrow and feebly bordered by still darker brown; lateral stripes pale brown; posterior sclerites of notum pale brown, the postnotum sparsely pruinose; basal half of scutellum with a capillary brown vitta that becomes obsolete at near midlength of sclerite. Pleura and pleurotergite uniform pale brownish yellow; dorsopleural membrane in front concolorous, a little darker brown behind. Halteres with stem obscure yellow, knob brownish black with whitened apex. Legs with coxae and trochanters brownish yellow; femora and tibiae obscure yellow, the tips rather narrowly brownish black; basitarsi obscure yellow, the tips darkened; tarsi passing into brownish black; claws (male) toothed, conspicuously hairy, especially on outer faces. Wings with a strong grayish suffusion, cells *C* and *Sc* more brownish yellow; stigma brown; a very small darkened cloud at origin of *Rs*; obliterative areas before cord very restricted to scarcely evident, indicated chiefly by a paling of the veins from before the stigma into the extreme base of cell *M*<sub>3</sub>; veins brown, brighter in the costal region. No stigmal trichia; squamal setae about six or seven. Venation: *R*<sub>1+2</sub> entire; *Rs* nearly twice the length of *m-cu*; cell 1st *M*<sub>2</sub> relatively long, narrower outwardly.

Abdomen chiefly brownish yellow, the tergites with a very indistinct

broken median darker brown stripe, the usual sublateral darkenings scarcely evident; caudal and lateral borders of tergites narrowly and inconspicuously pale; basal sternites obscure yellow, the outer segments more darkened; outer abdominal segments, including hypopygium, chiefly darkened. Male hypopygium relatively large and conspicuous; ninth tergite entirely separated from sternite; basistyle complete, conspicuously narrowed dorsally, near upper end on outer margin with a small rounded knob; accessory sclerite complete and unusually large, its area about one-half that of the basistyle. Ninth tergite extensive, of very peculiar formation; dorsal surface with a deep median furrow; entire posterior border almost detached from the main body of sclerite, separated by pale membrane only, greatly thickened, blackened and roughly corrugated; posterior lateral angles further produced into a stronger point; dorsal surface of apical collar with numerous very small setae; main body of sclerite with outer lateral angle produced into a blackened point, when viewed laterally appearing almost linear in outline. Outer dististyle irregular in outline, expanded outwardly, the outer apical angle more produced than the inner one. Inner dististyle powerful, the head and beak relatively small; outer margin near base with two strong spines, the more basal one with a rounded flange on its lower edge; outer basal lobe very loosely connected with the body of style, appearing as a broad, flattened yellow plate, its outer margin further produced into a more darkened flange with smooth borders. Appendage of ninth sternite bilobed, the larger lower portion with relatively few long conspicuous crinkly setae, those of the smaller, more dorsal lobule more numerous but less conspicuously wavy except at tips. Aedeagus relatively simple, terminating in two lateral points and two more slender, inner-lying spines. Eighth sternite relatively narrow but long and sheathing, its apex with a deep V-shaped notch, the lobes slender, each with brushes of unusually long and dense yellow setae.

*Habitat.* California.

*Holotype.* ♂, Monterey, March 25, 1926 (ex M. C. Van Duzee).

I can find no close relative of the present fly in our fauna. The details of structure of the male hypopygium, especially the ninth tergite and inner dististyle, indicate an isolated type. Superficially it suggests species such as *Tipula* (*Lunatipula*) *sternata* Doane, but there is no close affinity.

#### FURTHER NOTE ON *THERMONECTUS* (COLEOPTERA, DYTISCIDAE)

With reference to a recent short article by me, ("The Generic Name *Thermonectus* Dejean (Coleoptera, Dytiscidae)", Canadian Ent. 73 (11):197; published December 5, 1941), Mr. J. Balfour-Browne of the British Museum has very kindly drawn my attention to the following point. Aubé, 1838, Spec. général des Hydrocanthares, middle of p. 134, made "*Thermonectus* Esch.—Dej." a subdivision of *Acilius* Leach, 1817, and included thirteen species thereunder. The first of these, *mediatus* (Say), is placed now in the subgenus *Homocolytrus* Gobert of *Acilius*; the other twelve species of Aubé's arrangement are all *Thermonectes* Crotch, and the genotype of the latter should thus be cited as *Acilius* (*Thermonectus*) *ornaticollis* Aubé, 1838.

Hugh B. Leech, Vernon, B. C.

A REVISION OF THE *OBLIQUA-METATA* GROUP OF THE GENUS *ZALE*  
(LEPIDOPTERA, PHALAENIDAE) \*BY J. McDUNNOUGH,  
Ottawa, Ont.

For the past few years I have been working spasmodically on the species of this difficult group with a view to clearing up the existing confusion in nomenclature. To Smith must be given the credit for recognizing the fact that a greater number of species existed in the group than had been suspected by the older authors. Unfortunately in his revision of the genus (1908, Proc. U. S. N. M. XXXV, pp. 247-261) his treatment of this particular section left much to be desired, as I have already had occasion to point out (1940, Can. Ent. LXXII, 200); his type series in certain of the newly described species were evidently mixed, his sex-association faulty and his figures, purporting to represent the genitalia of some of the older species, based on misidentifications. I might also mention the practical impossibility of associating his genitalic slides with any definite specimens, due to lack of data on the slide-labels, as already noted by me (op. cit., 201). Smith's genitalic figures, it might be stated, are, on the whole, quite accurate but difficult of interpretation, owing to the fact that they have been drawn from the dorsal view instead of the more customary ventral one; on this account a good deal of the inner—and specifically important—characters are obscured and the references in the text to left and right sides must be transposed when considering the organs in situ.

Hampson in his treatment of the group (1913, Cat. Lep. Phal. Brit. Mus. XIII, pp. 238-242) offers nothing fresh and largely follows Smith; lack of material evidently hampered his work and his figures of the species involved are not particularly good. Since then the only other article dealing with these species has been that of Hainbach (1928, Trans. Am. Ent. Soc. LIV, pp. 227-229); his conclusions are erroneous and valueless and must be almost entirely disregarded.

In my own work I have been greatly assisted by the generous donations of material by Messrs. Lemmer and Buchholz of New Jersey, and by the recent receipt of long series of certain species from Mr. L. Rupert of Horseheads, N. Y., which has enabled me to study color variation within the individual species, to make numerous genitalic slides of both sexes and to tie down rather satisfactorily some of the older names concerning which I was in doubt. Considerable material from the rearings of our Forest Insect Survey Unit has also been at my disposal. The authorities of the U. S. National Museum have been most helpful in the loan or donation of specimens for study.

The genitalia in both sexes offer good characters for differentiation of the species and frequently, owing to similarity of pattern and color variation in several species, are the only sure means of establishing the correct identity. The general type of male genitalia is similar throughout the group; the sacculi are produced into asymmetrical chitinous arms, that of the left side being bent backward and hooked terminally while that of the right side remains a somewhat flat, slightly curved rod of varying breadth apically; at the base of each arm is a chitinous projection bearing a hair-tuft. One small group of species (which I call the *metata*-group) can be separated from the others due to the presence on the right side of a second projection and hair-tuft, situated nearer the base of the clasper; this can be noted in Smith's figures, Pl. XXXII, figs. 7, 8, 9, 11, although the specific names applied by him are not always correct. The remaining species can be further subdivided on the comparative lengths of the chitinous arms; in the one case (the *obliqua-duplicata* complex) the hooked arm of the left side is distinctly longer than the arm of the right side

\*Contribution No. 2256, Division of Entomology, Science Service, Department of Agriculture, Ottawa.



(*vide* Smith's figure 12); in the other (the *helata* complex) the arms are sub-equal in length (Smith's figures 10 and 13). The female genitalia also show good specific distinctions, although not so striking as those found in the male organs; the position of the ostium in the left lobe of the genital plate and the length of initial chitination of the ductus-tube are valuable; compare Smith's figure Pl. XXXIV, fig. 11 of a species in the *metata* group with figure Pl. XXXV, fig. 1 of *helata*.

Illustrations of both male and female genitalia—as far as possible—have been prepared for me by the excellent artist of our Forest Insect Survey, Miss M. MacKay, to whom I am much indebted for her painstaking and accurate work; such illustrations should render readily recognizable the various differentiating characters mentioned in the text.

In the following discussion of the species involved it has seemed advisable to apply names to some of the most striking forms in order to avoid confusion with very similar forms of other species; there are also the descriptions of two new species.

#### *Zale obliqua* Gn.

Pl. XIII, fig. 1; Pl. XIV, fig. 1.

*Homoptera obliqua* Guenée, 1852, Hist. Nat. Lep., VII, 16, Pl. XV, fig. 7.

*Phaeocyma obliqua* Smith, 1908, Proc. U. S. Nat. Mus., XXXV, 247, Pl. XXXIV, fig. 10, ♀ (*partim*, nec Pl. XXXII, fig. 7, ♂).

*Zale obliqua* Hampson, 1913, Cat. Lep. Phal. Brit. Mus., XIII, 242, (? Pl. CCXXX, fig. 20).

*Zale squamularis* Haimbach, 1928, Trans. Am. Ent. Soc. LIV, 227, Pl. XXIII, fig. 6, ♀ (*partim*).

Haimbach's figure gives a good representation of what I consider to be the female of this species. It is impossible to say whether Hampson's figure is correct or not; the reniform and the t. p. line are too strongly marked and the color is not accurate. Smith's figure of the male genitalia is incorrect.

The pale purplish-gray color with slight ruddy tinge, especially beyond the reniform, combined with the rather blurred and indistinct maculation, seems characteristic. There is not much difference between the sexes, except that the male usually shows a white spot above tornus. The outer border of the moderately distinct and rather broad, pale; antemedian band *touches the inner edge of the reniform* and runs contiguous with it; this allies the species with *squamularis* and separates it from *submediana* and *duplicata* where the same line runs well basad of the reniform, at least in the male sex.

**Male Genitalia.** Whole organ large; the hooked arm of the left clasper is *very long and thin*, markedly exceeding in length the corresponding arm of the right clasper. The aedeagus is long and thinner than usual,肘ed at 1/3, and either quite smooth or with the merest suspicion of preapical spicules on dorsal side (distinction from *submediana*).

**Female Genitalia.** These seem to have been correctly figured by Smith (Pl. XXXIV, fig. 10). The *curved nature* of the median line separating the lobes of the genital plate, bending as it does to the left before reaching the cephalic margin, the position of the ostium on this margin, and the direction of the initial, chitinated portion of the ductus bursae *toward the caudo-median separation point* of the two lobes, are all characteristic.

**Habitat.** Smith records "New York to Florida and probably throughout the Atlantic coast region to Canada and westward to the Mississippi"; but this needs checking; the Missouri record is referable to *confusa* McD. I have only seen the species from the Lakehurst, N. J., region and from Mountain Lake, Va. Gibson's record (1908, Ott. Nat. XXII, 136) from Bristol, Que., is erroneous, this specimen being referable to *submediana*. No definite Canadian records are known.

#### *Zale squamularis* Drury

Pl. XIII, fig. 2; Pl. XIV, fig. 2.

*Noctua squamularis* Drury, 1773, Index Ill. Exot. Ins., Vol. I (1770), 18, Pl. IX, fig. 3.

*Phaeocyma squamularis* Smith, 1908, Proc. U. S. Nat. Mus., XXXV, 253, (*partim*, nec Pl. XXXII, fig. 11, Pl. XXXV, fig. 2).

*Zale squamularis* Hampson, 1913, Cat. Lep. Phal. Brit. Mus., XIII, 241, (partim, nec. Pl. CCXXX, fig. 19).

*Zale squamularis* Haimbach, 1928, Trans. Am. Ent. Soc., LIV, 227, Pl. XXIII, fig. 5.

*Zale squamularis* ab. ♀ *lapidaria* Haimbach, 1928, op. cit., 228.

Hampson's figure is evidently made from a colored drawing and is unrecognizable. Haimbach's figure is a good representation of my idea of the species; Benjamin, according to the arrangement in the U. S. National Museum, had made a similar identification. Smith's genitalic figures of both sexes are incorrect and were evidently based on misidentifications. Smith is, however, correct in his statement that "the species represents a miniature *obliqua* with all the maculation intensified and made more contrasting." The strong, dark median line on primaries, separating a whitish antemedian band from the darker outer area, and, as in *obliqua*, running *contiguous to the reniform*, is very characteristic, especially in the males; the females are somewhat duller and browner than the males, with the white tornal spot—generally present in the males—only rarely indicated; a note by Benjamin under the series in the U. S. National Museum (information kindly furnished by Mr. C. Heinrich) states that *lapidaria* Haim. is merely the normal female form.

It is difficult to ascertain whether Smith had any specimens of the true *squamularis* before him when he wrote his revision. He mentioned 3 males and 2 females; of these two males, bearing Smith's identification labels and listed by Smith as "Washington, D. C., pupa found, iss. Mch. 2, '82," were in the U. S. National Museum from the C. V. Riley collection; one of these was kindly donated to me and a slide of the genitalia agreed rather better with Smith's figure of *metata* (Pl. XXXV, fig. 8) than it did with his fig. 11 of ostensible *squamularis*; I believe the two figures 8 and 11 represent merely a single species and that such differences as exist between the drawings are due largely to the positions of the objects on the slides or to possibly some local variation. I have not been able to match the female figure (Pl. XXXV, fig. 2) but it is certainly not *squamularis* as I define the species.

**Male Genitalia.** Very similar to those of *obliqua* but the whole organ considerably smaller. The hooked arm of the left clasper is noticeably shorter than the same part in *obliqua*, being still, however, longer than the arm of the right clasper. The aedeagus is thin, as in *obliqua*, but shorter, and the elbow occurs nearer the middle; there are usually a few preapical spicules visible on the left side.

**Female Genitalia.** Also very similar to those of *obliqua* but smaller, the right lobe of the genital plate being shorter and broader than the same lobe in *obliqua*. The median line of separation between the two lobes does not *bend quite so strongly to the left* to attain the cephalic margin of the plate and the initial chitinous portion of the ductus bursae is more upright and more nearly parallel to the outer margin of the plate than in *obliqua*.

**Habitat.** I only know the species from the Lakehurst region of New Jersey, but it will probably occur all down the Atlantic Coast region from New York southward; the records given by Smith and Haimbach need checking. It has not been reported from Canada.

#### *Zale submediana* Strand

Pl. XIII, fig. 3; Pl. XIV, fig. 3.

*Zale obliqua* ab. I. Hampson, 1913, Cat. Lep. Phal. Brit. Mus. XIII, 243.

*Zale obliqua* ab. *submediana* Strand, 1916, Arch. f. Naturgesch. A. (2), 44.

Strand's name was based on Hampson's "Ab. I" of *obliqua*, the type in the British Museum, of which I have a photograph, being a male from the Grote Collection, presumably from New York State.

I believe the species was first recognized by Benjamin and the Lakehurst Collectors. It is as large as *obliqua* and very similar in general appearance; the color, however, is a deeper purple-gray with less of the ruddy tinges of *obliqua* and the maculation is more definite, the t. p. line at times being quite blackish.

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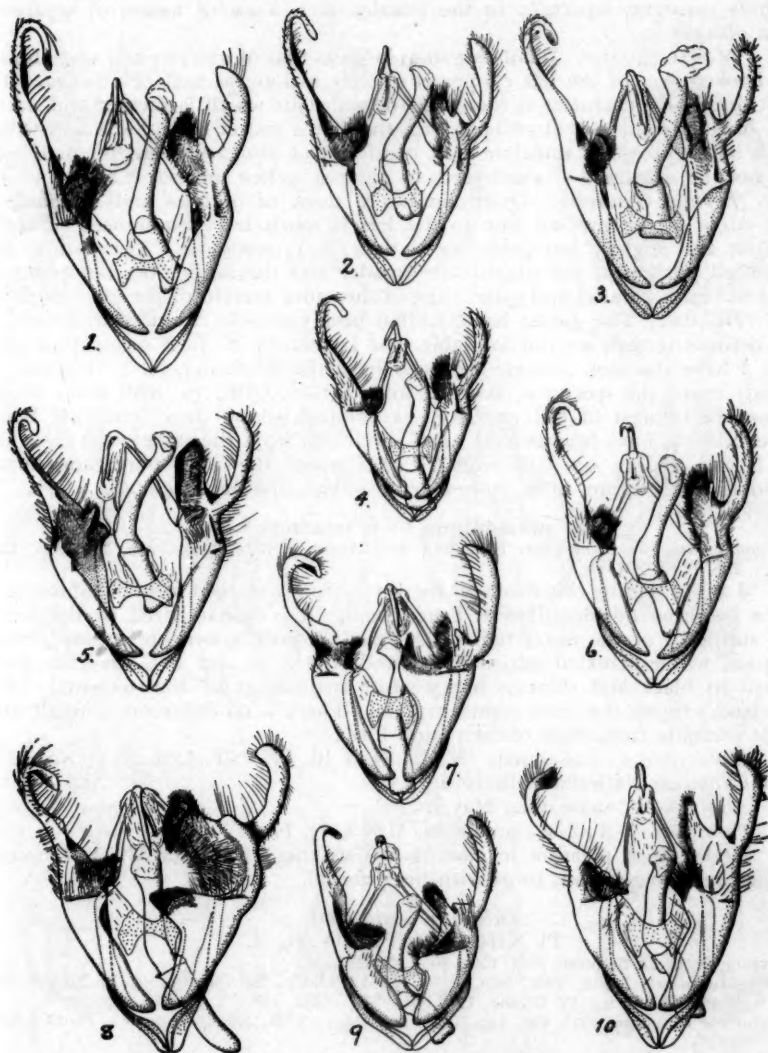
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PLATE XIII.



VENTRAL VIEW OF MALE GENITALIA.

- 1, *Zale obliqua* Gn., Lakehurst, N. J. 2, *Zale squamularis* Drury, Lakehurst, N. J.  
3, *Zale submediana* Strand, Lakehurst, N. J. 4, *Zale duplicata* Beth., Sullivanville, N. Y.  
5, *Zale helata* Sm., Lakehurst, N. J. 6, *Zale buchholzi* n. sp., Lakehurst, N. J. (Holotype).  
7, *Zale curema* Sm., Raleigh, N. C. 8, *Zale confusa* McD., Hope, Ark. (Holotype).  
9, *Zale metata* Sm., Washington, D. C. (?). 10, *Zale metatoides* n. sp., Horseheads, N. Y. (Paratype).

The pale antemedian band is frequently quite lavishly sprinkled with white scaling and the line of demarcation between this area and the outer darker suffusion runs generally distinctly basad of the reniform; while this character is not entirely constant, especially in the females, it is a useful means of separation from *obliqua*.

*Male Genitalia.* Whole organ as large as that of *obliqua* and very similar; the hooked arm of the left clasper is scarcely as long as that of *obliqua*. The most distinctive character is found in the aedeagus which is shorter and noticeably broader than that of *obliqua* with the elbow nearer the middle and with a much larger preapical spiculate area, consisting of numerous rows of small teeth and not the isolated 3-7 small teeth of *obliqua* (when present at all).

*Female Genitalia.* Quite similar to those of *obliqua* and *squamularis*. The curve of the median line to the left is much less pronounced than in *obliqua* and slightly less pronounced than in *squamularis*. The ostium and chitinated portion of the ductus are broader and the latter does not point inward but runs parallel and quite close to the outer margin of the genital plate.

*Habitat.* The species has doubtless been generally confused with *obliqua* and definite records are not available. At Lakehurst, N. J., it seems quite common; I have also seen a single specimen from the Rochester, N. Y., region. As already noted the specimen recorded from Bristol, Que., (a small town on the Ottawa River west of Ottawa City) as *obliqua* belongs here, and our Forest Survey officers have bred several more specimens from the same general region, the larvae feeding on jack pine (*P. banksiana*); the range north and inland would seem, therefore, to be more extended than that of *obliqua*.

#### *Zale submediana* form *lemmeri* f. nov.

*Zale squamularis* var. *benesignata* Haimbach (nec Harvey), 1928, Trans. Am. Ent. Soc., LIV, 228, Pl. XXIII, fig. 7.

I am proposing this name for the very strongly marked form of *submediana* which has been misidentified as *benesignata*. It is characterized by the heavy dark suffusion of the outer half of the median area, contrasting sharply with the pale, white-sprinkled antemedian band; the t. p. and s. t. lines are well-defined in black and there is heavy white sprinkling in the terminal area. Haimbach's figure is a good representation. There is no difference in male and female genitalia from those of the typical form.

*Holotype*—♂, Lakehurst, N. J., April 16, 1930 (F. Lemmer); No. 5431 in the Canadian National Collection.

*Allotype*—♀, same data, May 7.

*Paratypes*—2 ♂, 2 ♀, same data, May 7, 11, 14.

I take much pleasure in naming this striking form after Mr. F. Lemmer who has been so generous to us with his material.

#### *Zale duplicata* Beth.

Pl. XIII, fig. 4; Pl. XIV, fig. 4.

*Homoptera duplicata* Bethune, 1865, Can. Jour., X, 257.

*Phaeocyma duplicata* Smith, 1908, Proc. U. S. N. M., XXXV, 258 (partim, nec Pl. XXXII, fig. 13, Pl. XXXV, fig. 5); Gibson, 1908, Ott. Nat. XXII, 135.

*Zale duplicata* Hampson, 1913, Cat. Lep. Phal. Brit. Mus., XIII, 240 (partim, vix Pl. CCXXX, fig. 17).

#### form *benesignata* Harvey

*Homoptera benesignata* Harvey, 1875, Bull. Buff. Soc. Nat. Sci., III, 14.

*Phaeocyma benesignata* Smith, 1908, Proc. U. S. N. M., XXXV, 256, Pl. XXXII, fig. 12, Pl. XXXV, fig. 3.

*Zale benesignata* Hampson, 1913, Cat. Lep. Phal. Brit. Mus., XIII, 238, Pl. CCXXX, fig. 14, (Type).

#### var. *largera* Smith

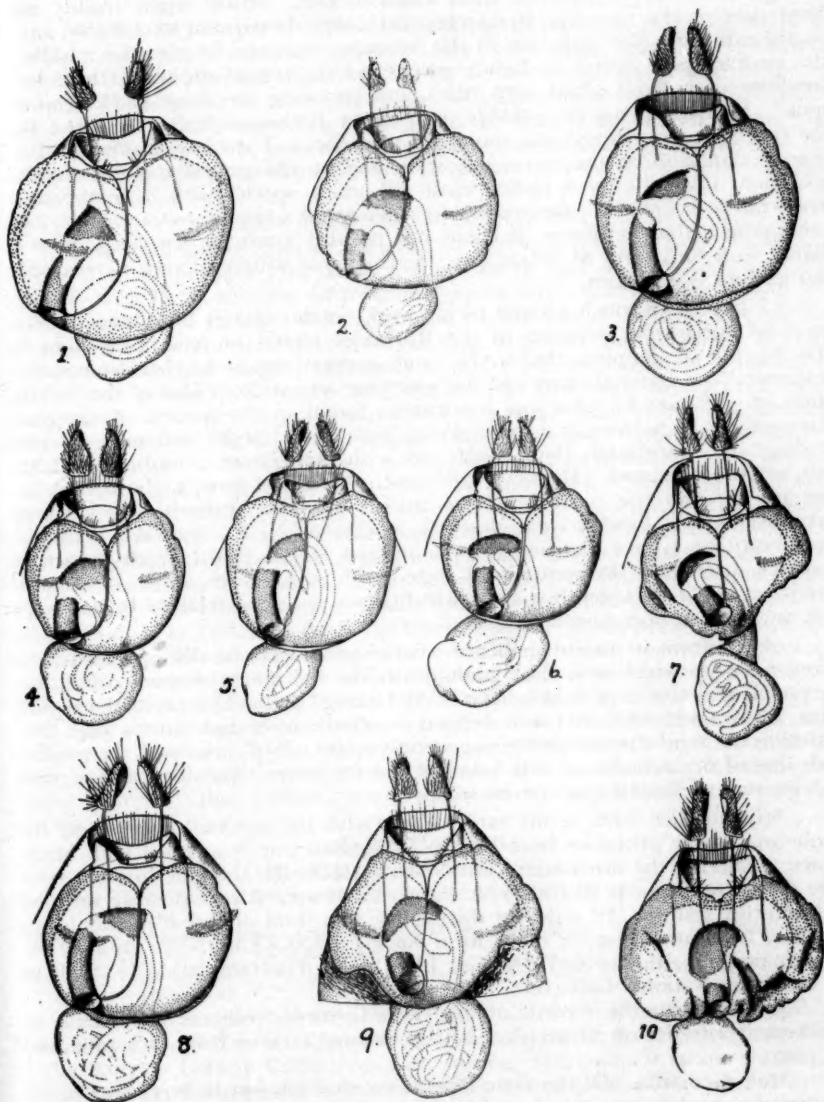
*Phaeocyma largera* Smith, 1908, Proc. U. S. N. M., XXXV, 257, Pl. XXXV, fig. 4.

*Zale largera* Hampson, 1912, Cat. Lep. Phal. Brit. Mus., XIII, 242.

The correct identity of *duplicata* has evidently proved a stumbling block to previous reviewers. It was described from specimens from Cobourg, Toronto



## PLATE XIV.



## FEMALE GENITALIA

- 1, *Zale obliqua* Gn., Lakehurst, N. J. 2, *Zale squamularis* Drury, Lakehurst, N. J.  
 3, *Zale submediana* Strand, Lakehurst, N. J. 4, *Zale duplicata* Beth., Horseheads, N. Y.  
 5, *Zale helata* Sm., Lakehurst, N. J. 6, *Zale bethunei* Sm., Tryon, N. C. (Paratype). 7, *Zale*  
*curema* Sm., Hope, Ark. 8, *Zale buchholzi* n. sp., Lakehurst, N. J. (Allotype). 9, *Zale*  
*metatoides* n. sp., Ocean Co., N. J. (Paratype). 10, *Zale confusa* McD., Raleigh, N. C.

and London, all towns in Southern Ontario, and the types are destroyed. There is, however, an old and rather poor male specimen before me, *ex Coll.* Entomological Society of Ontario, from London, Ont., which might readily have been part of the type lot; it matches Bethune's description excellently and I would call particular attention to the following portion: "Across the middle of the median space, which is slightly paler than the rest of the wing, there is an irregular dark band edged with black and enclosing the deep black reniform spot." While it is not improbable, judging by Bethune's further remarks, that the type series was mixed and contained two species, I am basing my identification of *duplicata* on the above quotation and on the genitalia of the London specimen; this calls for a rather small (35 mm.) species with *distinct line of demarcation between a paler antemedian band and a darker outer median area*, containing a dark reniform; it could not possibly apply, as has been done by Smith, to a dull form of *helata* Sm., in which the differentiation between the two sections is very faint.

I have been much assisted in my work on this species by a long series of excellent specimens, collected in the Rochester region of New York State in May by Mr. L. Rupert; this is the same general region as that from which Bethune's type material came and has given me an excellent idea of the striking range of variation in color and maculation found in the species. *Benesignata* Harv. proves to be merely a form of *duplicata* with heavier and more decided shading and maculation than usual and with consequent prominence of the pale antemedian band. Harvey's male type, of which I have a photograph before me through the courtesy of the British Museum authorities, was from Grimsby, Ont., a locality even closer to Rochester, N. Y., than are Bethune's type localities; I have matched the photograph almost exactly with certain of Rupert's specimens; the genitalia of these are identical with those of normal *duplicata* and it is evidently a form which bears the same relation to *duplicata* that my *lemmeri* does to *submediana*.

Apart from its much smaller size, this species may be distinguished from *submediana*—to which it is close genitally—by the much browner coloration, the purple-gray shades of *submediana* being lacking; the basal area, in the typical form, is deeper in color and well defined outwardly by a dark line; a pale line, outlining the reniform outwardly, is generally quite conspicuous and the median dark line of demarcation is well basad of the reniform. The form *benesignata* appears very similar to a miniature *lemmeri*.

Still another form occurs rarely along with the others; in this form the whole area of the primaries from base to submedian line is suffused with black-brown, rendering the maculation quite obscure, although the pale line on outer edge of the reniform is still marked; the terminal area is considerably suffused with whitish scaling. In order to distinguish this from almost identical forms of *helata* I am proposing for it the form name *FRANCLEMONTI*, my type being a male from Ithaca, N. Y., May 4, 1938 (J. G. Franclemont); No. 5432 in the Canadian National Collection.

According to the records of our Forest Survey officers the larva of *duplicata* is a feeder on white pine, with occasional records from jack pine and red pine.

**Male Genitalia.** Of the same type as *submediana* but in every way much smaller; the clasper arms are short but the hooked left arm still remains longer than the right one which is generally flattened and truncate apically; the hair-tufts at the bases of the arms are smaller than in *submediana* as is also the aedeagus, in which the cluster of preapical spicules is present but somewhat reduced in number. Smith's figure (Pl. XXXII, fig. 12) is quite accurate.

**Female Genitalia.** At once distinguished from those of *submediana* by the shorter length of the chitinized initial section of the ductus bursae and its more upright position, further removed from the outer margin of the genital

plate. Except for its much smaller size the organ is otherwise very similar to that of *submediana*; Smith's figures (Pl. XXXV, figs. 3 and 4) give a good idea of it.

**Habitat.** The records will need checking; in the U. S. A. I only know it definitely from the Rochester region of New York State, but Smith's records from New Hampshire and Maine can easily be correct as the general range of the species appears to be rather northern. In Canada it occurs in the White Pine areas of Ontario, extending eastward to the Ottawa River; our Forest Survey officers have bred it from various Quebec localities in the Ottawa and St. Lawrence regions and we also have several specimens from Nova Scotia (Digby, Kentville).

#### *Zale duplicata* var. *largera* Sm.

I am holding *largera* as a varietal name as it appears to be rather definitely associated with the Jack Pine areas in the eastern half of the Dominion and probably with *Pinus contorta latifolia* (lodgepole pine) and *P. monticola* in the west. As the name implies—although Smith's Latin would probably give purists the shudders—the race is somewhat larger than *duplicata* (although not as large as *submediana*) and there is generally considerable indication of purple-gray suffusion on primaries, a feature not, however, so noticeable in captured specimens as in bred ones. The name was based on a single male (without abdomen) from Vancouver Is., B. C., and a female from Winnipeg, Man., in the Barnes Coll. (now in the U. S. Nat. Mus.); as the two localities are so widely separated and since the female genitalia are figured by Smith (Pl. XXXV, fig. 4) I take the precaution of designating the Winnipeg female as holotype, in case at some later date differences between west-coast and eastern specimens should be detected sufficient to justify racial separation. I have seen no Manitoba specimens but have a small series from the Rainy River district of Ontario (Hymers), adjacent to the Manitoba border, and also specimens from further east in Ontario and north of Lake Huron as far as the Quebec border (Biscotasing; Larder Lake; Laniel, Qué.). Practically all the eastern breeding records report the larva on Jack Pine. I can detect no differences in genitalia between *largera* and *duplicata* and a comparison of Smith's figures (Pl. XXXV, figs. 3 and 4) bears this out.

Our western specimens consist of single females from Waterton, Alta., and Wellington, Vanc. Is., B. C., and a pair of specimens from Salmon Arm, B. C. These vary so much among themselves in color and maculation (although with similar genitalia) that I shall have to await the receipt of further material before deciding the status.

#### *Zale helata* Sm.

Pl. XIII, fig. 5; Pl. XIV, fig. 5.

*Phaeocyma helata* Smith, 1908, Proc. U. S. Nat. Mus., XXXV, 252, Pl. XXXII, fig. 10, Pl. XXXV, fig. 1.

*Phaeocyma duplicata* Smith, 1908, Proc. U. S. Nat. Mus., XXXV, 258 (partim, Pl. XXXII, fig. 13, Pl. XXXV, fig. 5).

*Zale helata* Hampson, 1913, Cat. Lep. Phal. Brit. Mus. XIII, 240, Pl. CCXXX, fig. 17 (as syn. *duplicata* in err.).

*Helata* was described from material (3 ♂, 2 ♀) from New Hampshire, Massachusetts, and New York, and the holotype is a male from New Hampshire, in the Rutgers College Collection, with missing abdomen; it seems reasonable to suppose that the genitalic slide and Smith's drawing were based on this specimen. Typical *helata*, according to a Lakehurst specimen before me compared with Smith's type by Mr. O. Buchholz, is rather bright brown in color (as compared with the smoky-brown of *duplicata*) with sharp and well-defined maculation; the dark t. a. line with an inner shading of brown is quite striking but, on the other hand, the median line is feeble as compared with that of *duplicata*, and there is very little distinction in color between the inner and outer portions of this area; there is generally some ruddy shading between the reniform and the dark t. p. line which shows a long, acute, inward angulation at this point,

and the white patch in the males above tornus is well-defined. A series of such specimens is before me from Lakehurst, N. J. (May).

In the Rochester, N. Y., region the species occurs quite commonly in May and June in a somewhat smaller and darker form and it was this form that was evidently confused by Smith with *duplicata* as shown by a Hamilton, Ont., specimen in our collection with Smith's label, *duplicata*. The Rochester series of specimens shows the same trend toward melanism as was found in the *duplicata* series; in fact, only by recourse to the genitalia have I been able to determine to which species dark specimens belong, so similar in general appearance have they become. For this melanic form in which practically the whole forewing is suffused with black-brown, leaving a striking white tornal patch (even in females), I propose the name, form. *RUPERTI*, my type being a male, Horseheads, N. Y., May 28, 1941 (L. R. Rupert). No. 5433 in Canadian National Collection. Intermediates to the typical form occur quite frequently.

From our records the larva appears to feed on both white pine and jack pine.

**Male Genitalia.** At once separable from those of *duplicata* by the *sub-equal character of the clasper arms*, the hooked arm of the left side not noticeably exceeding in length the right rod-like arm; the hair-tufts at the bases of these arms are *stronger, more extended* (especially on the right side); and darker in color than those of *duplicata*. The elbowed aedeagus is decidedly *longer and thinner* with a fairly well-defined patch of preapical small spicules. (Vide Smith's figures, Pl. XXXII, figs. 10 and 13).

**Female Genitalia.** Best separated from those of *duplicata* by the *greater length of the chitinization* of the initial section of the ductus bursae which bends outward and runs *close to the outer edge* of the left lobe of the genital plate (Vide Smith's figures, Pl. XXXV, figs. 1 and 5).

**Habitat.** New England and Northern Atlantic States extending inland to the Great Lakes region. In Canada the species occurs in Southern Ontario (Hamilton, Pontypool) and we also have a few specimens from the Ottawa River region, west of Ottawa city (Norway Bay, Aylmer).

A small series of a rather perplexing form has been sent me which seems to have been confused by Smith under his name *curema*; at least to one of the specimens a label has been attached by Mr. O. Buchholz stating that it agrees with Smith's female type of *curema*. That it is not the true *curema* is very evident from a genitalic study, both male and female organs agreeing very closely—as far as I can see—with those of my typical Lakehurst specimens of *helata*. In view, however, of certain differences in maculation, hardly consistent with mere individual variation, I am inclined to consider the series as representing a good species which I described as follows:

***Zale buchholzi* n. sp.**

Pl. XIII, fig. 6; Pl. XIV, fig. 8.

Wings of the same even light-brown color found in Lakehurst *helata*; the size, however, is slightly larger and the maculation is *much less evident*. The t. a. line, instead of being strongly marked and shaded inwardly with dark brown, is thin, faint and *without any brown shading on basal side*; the t. p. line is much less evident and its inward angle opposite the reniform *much shorter and less acute*. The males show the usual white tornal spot, but there is otherwise little white terminal sprinkling. Expanse 40 mm. In the male, except perhaps for some slight reduction in the tufting, I can detect no definite distinction from the genitalia of *helata*; in the female the median line of demarcation between the lobes of the genital plate bends more sharply to the left above the cephalic margin than in the case in *helata* and the whole plate is broader.

**Holotype**—♂, Lakehurst, N. J., May 2 (F. Lemmer), No. 5434 in Canadian National Collection.

**Allotype**—♀, Same data, May 11.

**Paratypes**—2 ♂, 1 ♀, same data, May 7, 11, 16.



**Zale bethunei Sm.**

Pl. XIV, fig. 6.

*Phaeocyma bethunei* Smith, 1908, Proc. U. S. Nat. Mus., XXXV, 260, Pl. XXXIII, fig. 1, Pl. XXXV, fig. 6.

*Zale bethunei* Hampson, 1913, Cat. Lep. Phal. Brit. Mus., XIII, 240, Pl. CCXXX, fig. 18.

The name was based on eight specimens (2 ♂, 6 ♀, according to Smith) from Washington, D. C., Tryon, N. C. (Fiske), and Maine. The holotype is a male in the Rutgers College Coll. from Tryon, N. C., with abdomen intact; it is clear, therefore, that Smith's male genitalic drawing was not based on this specimen. In the U. S. National Museum, according to information furnished by Mr. C. Heinrich, are two male "cotypes" from Washington, D. C., without abdomens; it is likely that one of these furnished the male genitalic slide, which, however, is not in the National Museum Collection. Besides these cotypes the Washington Collection contains the female "Type" and two female "Cotypes" from Tryon, N. C., (one of these has since been generously donated to the Canadian National Collection) and a female "Cotype" from Maine (ex. Coll. Brooklyn Museum), all with intact abdomens. This information would indicate that Smith must have had three males in his type series and not two as stated, and that a single female (on which the drawing must have been based) has not been located.

My only knowledge of the species is from the rather worn "Cotype," now in our collection. It is a small, much suffused species and has the general appearance of the melanic form of *helata* from Horseheads, N. Y., but with a more prominent ruddy patch beyond the reniform. I have made a slide of our Tryon female (which is toptotypical) and find it agrees excellently with Smith's figure 6; while allied to *helata* it differs—as can be seen by comparing Smith's figures—in the shorter length of the initial, chitinized portion of the ductus bursae and its more upright position, being further removed from the left edge of the genital plate. Of the male genitalia I can say nothing; Smith's figure was made from a rather distorted slide as he himself points out (p. 274) but, as far as can be told, the resemblance to *helata* is marked.

Omitting the Maine specimen, which quite possibly may not be conspecific, *bethunei* would seem to be more southern in its habitat than *helata*; the time of appearance (August) would also indicate a different species, unless we are dealing with a second generation.

The following species all belong in what I have called the *metata* group, a complex of species of very similar superficial appearance but separable on good genitalic characters. As already noted, the male genitalia possess a *second hair-tuft* on the right side toward the base, not found in the previous groups; in the female genitalia the lobes of the genitalic plate are subequal, the median line of demarcation being upright and not curving to the left above the cephalic margin; this margin is in some cases *laterally excavated* and not evenly convex, or the lobes may show deep depressions in the areas adjacent to the median line.

**Zale metata Sm.**

Pl. XIII, fig. 9.

*Phaeocyma metata* Smith, 1908, Proc. U. S. N. M., XXXV, 248, Pl. XXXII, fig. 8 (♂) (? Pl. XXXIV, fig. 11, ♀) (*partim*).

*Phaeocyma squamularis* Smith, 1908, Proc. U. S. N. M., XXXV, 253 (*partim*, Pl. XXXII, fig. 11).

*Zale metata* Hampson, 1913, Cat. Lep. Phal. Brit. Mus., XIII, 239 (*nec* Pl. CCXXX, fig. 15).

*Zale metata* Haimbach, 1928, Trans. Am. Ent. Soc. LIV, 228 (? Pl. XXIII, fig. 8) (*partim*).

*Metata* has probably been the most misidentified species in the whole group; this is in large measure due to the mixed nature of Smith's type series which contained at least two and possibly three distinct species; it is also partially due to the close similarity of the various species and the difficulty of identification without recourse to genitalic slides. Hampson was unacquainted with the species and his figure was based on a colored drawing of a New York specimen, probably not the true *metata* but referable to the following species.

Haimbach's figure is difficult to place, but I should hazard a guess that it represented *curema* Sm. and not *metata*; his general conclusions are, of course, quite erroneous and should be disregarded. Smith's name was based on ten specimens (4 ♂, 6 ♀) from states all the way from New York to Florida. As indicated by Haimbach, the holotype is a male in the Rutgers College Coll. from Florida, without abdomen; of the nine remaining specimens the female "Type" from Virginia and two other "Cotypes" are also at Rutgers; five others (2 ♂, 3 ♀) are in the U. S. National Museum, leaving only one "Cotype" unaccounted for. None of the other Cotypes is without abdomen so I believe there is considerable justification in considering that Smith's slide and drawing (fig. 8) were actually based on the holotype specimen. Through the co-operation of the U. S. National Museum authorities, I have recently been enabled to examine and to make genitalic slides of male and female Cotypes from Tryon, N. C.; these prove to belong to the species I described a few years ago as *confusa* and are not the true *metata*. There is also considerable likelihood that the New York specimens in Smith's series belong to a third species which I am describing; Smith's figure of the female genitalia (Pl. XXXIV, fig. 11) may readily have been made from a specimen from this region and bears great similarity to the genitalia of my new species. On this point, however, I cannot be certain, as I have seen no female specimens which I could definitely place under *metata*.

As already stated under *squamularis* a male specimen, considered by Smith to be this species and so labelled, was kindly presented to us by the U. S. N. M. authorities; its genitalic slide is an excellent match for Smith's figure of *metata* and I am, in consequence, holding the specimen as representing the true species. It is a bred specimen from the C. V. Riley collection, marked "iss. March 2, '82"; no other data is given on the label, but Smith records it as from Washington, D. C. When checked with Smith's original description it agrees in all salient features and I would draw particular attention to the following excerpts from this description. "Light fawn brown, tending to gray..... T. a. line ..... sometimes a little more defined by an edging of dark scales; never a black line;..... There is a broad band-like area to the middle of the median space that is usually lighter than the rest of the wing and is gray-powdered;..... beyond it (i. e. reniform) a more reddish shading to the t. p. line ..... Beyond the s. t. line is a dusky, somewhat glaucous band or shade ..... There is a tendency toward strigillation of the terminal space and toward a series of pale terminal spots." To this might be added the note that the median line runs basad of the reniform.

**Male Genitalia.** Smith's figure (Pl. XXXII, fig. 8) is quite accurate and his figure 11 appears to represent the same thing from a somewhat different angle. The two arms of the claspers are subequal, the hook of the left arm not greatly downcurved and rather pointed and the right arm considerably flattened apically. On the right clasper the apical hair-tuft is situated on a projecting strap-like piece of chitin with rather truncate apex; the basal tuft is on a slight rounded projection of the sacculus, connected by a ridge with the base of the arm. The aedeagus is moderate in width and length, elbowed before the middle and with a weak spiculate patch on underside.

**Female Genitalia.** Unknown.

**Habitat.** Apparently southern. The only localities I can quote are "Florida" and the doubtful "Washington, D. C. (C. V. Riley)."

#### *Zale metatoides* n. sp.

Pl. XIII, fig. 10; Pl. XIV, fig. 9.

Close to *metata* in color and maculation and very generally confused with this species. The primaries are of a slightly deeper shade of brown and there is a distinct purple-gray suffusion especially in the antemedian band which is lacking in *metata*. The maculation is rather obscure, the t. a. line being indicated merely by the difference in shade between the brown basal area and the

purplish-gray antemedian band. The median line is rather irregular but runs *contiguous with the inner edge of the reniform* (distinction from other species of the group). The lunate reniform is quite dark with faint ruddy shading beyond to t. p. line; this line obscure and with only weak indentation opposite reniform. S. t. line outlined in black in inner half of wing as usual. Slight whitish strigations in terminal area, terminating (in the male) with the usual white tornal patch; faint smoky shading also in central section of this same area. Secondaries as usual. Expense 38 mm.

**Male Genitalia.** Clasper-arms subequal, short and rather bent; the left hooked arm with *broad, flat apex* and with only small basal hair-tuft on a hollowed, short, inward-projected piece of chitin; the right arm flattened and bent, with the weak apical hair-pencil on a *thin finger-like projection of chitin* and the strong, dark basal tuft on a *large, blade-shaped piece of chitin*, projecting obliquely inward and caudad from the inner margin of sacculus. Aedeagus moderate in size, less strongly elbowed than usual, with rather large patch of very fine, preapical spicules on left dorsal side.

**Female Genitalia.** Very similar to Smith's figure Pl. XXXIV, fig. 11, which probably represents this species. Genital plate broader than high, the lobes subequal with upright median, dividing line and *strong, lateral, ear-like, chitinous projections* which break the even convex character of the cephalic margin of the plate. Ostium at the cephalic end of the median line on the left side but not touching margin of plate; ductus bursae with very short, initial, chitinized section, slightly outwardly oblique. Very strong, dark clothing of scales on the integument on each side of the cephalic margin of the genital plate.

**Habitat.** Northern Atlantic States, extending inland to the Great Lakes region. There is a single female in our collection from Marchand, Man., on the eastern border of the province, which was bred by our Forest Survey Unit.

**Holotype**—♂, Lakehurst, N. J., June 11 (F. Lemmer). No. 5435 in Canadian National Collection.

**Allotype**—♀, Same data.

**Paratypes**—1 ♂, 1 ♀, Lakehurst, N. J., May 14, June 26 (F. Lemmer); 1 ♀, Ocean Co., N. J., June 2 (O. Buchholz); 1 ♀, Mansfield, Pa., June 7 (L. R. Rupert); 3 ♂, 5 ♀, Horseheads, N. Y., May 20, 28, June 3, 8, 24 (L. R. Rupert).

The female from Ocean Grove bears a label "*Z. metata*. Compared with type, Buchholz," which is confirmation that Smith's had the present species mixed in with his *metata* types. The Horsehead specimens are somewhat darker purple-brown in color than the New Jersey ones, but are similar in genitalia. My single bred Manitoba specimen, mentioned above, shows a very deep purple suffusion over the primaries but also agrees in genitalia.

#### **Zale curema Sm.**

Pl. XIII, fig. 7; Pl. XIV, fig. 7.

*Phaeocyma curema* Smith, 1908, Proc. U. S. N. M., XXXV, 250, Pl. XXXII, fig 9, Pl. XXXIV, fig 12.

*Zale curema* Hampson, 1913, Cat. Lep. Phal. Brit. Mus., XIII, 239, Pl. CCXXX, fig. 16.

*Zale curema* Haimbach, 1928, Trans. Am. Ent. Soc., LIV, 229 (syn. of *metata* in err.) (? Pl. XXIII, fig. 8).

This species is much the darkest in the group, the primaries (especially in fresh specimens) being a deep smoky purple-brown with *t. p. line outlined in black* and a *prominent blackish reniform*; the maculation is otherwise much as in *metata*. The holotype is a male from Center, N. Y., with intact abdomen in the Rutgers College Coll., which also contains the female "Type" from Pennsylvania. Most of the remaining "Cotypes" are in the U. S. National Museum, including probably the specimens from which slides and drawings were made. Smith's genitalic drawings are easily recognizable and he does not seem to have mixed up his series as he did with *metata*. Hampson's figure, while evidently of *curema*, is scarcely dark enough. Haimbach's material of his so-called "*metata*"

consisted probably largely of *curema* specimens; I have examined a Florida female and a Raleigh, N. C., male through the courtesy of the authorities of the Academy of Natural Science, Philadelphia, and these are both *curema*.

**Male Genitalia.** (See Smith's figure, Pl. XXXII, fig. 9). Slightly smaller than the genitalia of *metatoides* but in general quite similar. The main distinction is found in the two hair-tufts of the right clasper; they are closer together and the apical one is on a short, broad, rounded, chitinous projection and not on a finger-like one as in *metatoides*, the knife-like projection containing the second tuft is much as in *metatoides*. On the left side the hair-tuft is darker and more prominent than in *metatoides* and the chitinous area containing it is less hollowed out and does not project inward. The aedeagus is much as in *metatoides*.

**Female Genitalia.** Genital plate smaller than in *metatoides* and very broad for its height; lateral, ear-like, chitinous projections of lobes much less prominent; the cephalic margin is sinuous with a small median notch; median line of demarcation upright. On the left lobe laterally are two raised, parallel, ridges on which the usual hair-tuft is based. Ostium situated much as in *metatoides*, slightly smaller and well removed from cephalic margin of plate; chitinized portion of ductus bursae rather longer than in the allied species.

**Habitat.** Appears to be wide-spread over the entire eastern United States. We have specimens in the collection from Nantucket, Mass., Horseheads, N. Y., Raleigh, N. C., and Hope, Arkansas, and I have examined Florida specimens. Some of Smith's records show very early spring dates but our material was all captured from June to early August. I know of no Canadian records.

#### ***Zale confusa* McD.**

Pl. XIII, fig. 8; Pl. XIV, fig. 10.

*Phaeocyma obliqua* Smith (nec Guenée), 1908, Proc. U. S. Nat. Mus., XXXV, 247, Pl. XXXII, fig. 7 (partim).

*Phaeocyma metata* Smith (nec Smith) 1908, Proc. U. S. Nat. Mus., XXXV, 248 (partim).

*Zale confusa* McDunnough, 1904, Can. Ent., LXXII, 200.

The species is the palest and most poorly maculate of the group; the general color is a light fawn-brown, diffused with a pale ruddy shade, and in certain lights the primaries show a faint metallic lustre, especially in the ante-median and terminal areas of the males; the females (when old, especially) show less of this. The maculation is indistinct, the lower dark portion of the s. t. line and a dull smoky reniform being the most obvious features. As already pointed out, Smith confused it with both *obliqua* Gn. and his own *metata*.

**Male Genitalia.** (See Smith's figure, Pl. XXXII, fig. 7, which is good). Whole organ large; clasper-arms short and subequal; the hair-tuft of left side is weak and situated on a flat chitinous area projecting truncate inward; the apical hair-tuft of the right side is large and situated on a long, broad, inwardly oblique projection; the second tuft is on a strong, rounded, inward projection, halfway to base of clasper. The area between the two tufts is large and hollowed out. Aedeagus long and rather thin, not strongly elbowed, with very weak preapical patch of spicules.

**Female Genitalia.** Very characteristic. Lobes of genital plate broader than high; median line of demarcation poorly marked, upright, arising from a slight indentation on caudal margin; cephalic margin somewhat irregularly convex with a broad, shallow, median excavation; an oblique, chitinous ridge near lateral edge of each lobe; the right lobe with a large, irregular depression above the cephalic margin toward median line. Ostium entirely central and situated in the centre of the median excavation of the cephalic margin of plate, pointing cephalad. Initial chitinized portion of ductus bursae short and upright.

**Habitat.** Apparently quite southern in its range. The four specimens in our collection (2 ♂, 2 ♀) are from Raleigh, N. C. (Aug.); Missouri (probably Kirkwood); Hope, Arkansas, June 21; and Agricultural Coll., Mississippi. Two specimens in the U. S. N. M. (as *metata*) are from Tryon, N. C. (August).

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